GREGG SCOTT JAEGER

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Natural Sciences and Mathematics,
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CITIZENSHIP:

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AREAS OF PUBLICATION:

Quantum Computing, Quantum Cryptography, Foundations of Quantum Mechanics, Quantum Metrology, History and Philosophy of Science, Quantum Optics, Stochastic Processes, Genetics

EDUCATION:

Ph.D. in Physics, January 1995, Boston University
B.S. in Mathematics, June 1986, University of Wisconsin–Madison
B.S. in Philosophy, June 1986, University of Wisconsin–Madison
B.S. in Physics, June 1986, University of Wisconsin–Madison

CAREER HISTORY:

Fall 2009–present: Associate Professor, Natural Sciences and Mathematics,
College of General Studies, Boston University, Boston MA, USA
2003–Spring 2009: Assistant Professor, Natural Science,
College of General Studies, Boston University, Boston MA, USA
2001–2003: Senior Research Associate, Quantum Imaging Laboratory
Electrical and Computer Engineering, College of Engineering, Boston University, Boston MA, USA
1999–2001: Director of Research, Quantum Computing,
MagiQ Technologies, Somerville MA, USA
1999: Chief Scientist, Quantum Information,
Starlab nv, Brussels–Zaventem, Belgium
1998–1999: Senior Research Associate, Quantum Imaging Laboratory,
Electrical and Computer Engineering, College of Engineering, Boston University, Boston MA, USA
1998-1999: Guest Researcher, Physics Laboratory, Optical Technology Division,
National Institute of Standards and Technology (NIST), Gaithersburg MD, USA
1997–1998: Lecturer, Department of Mathematics,
College of Arts and Sciences, Boston University, Boston MA, USA
1996–1997: Lecturer, Department of History and Philosophy of Science,
Stonehill College, Easton MA, USA
1994–1997: Assistant Professor, Natural Science,
College of General Studies, Boston University, Boston MA, USA

BOOKS:

[1] Gregg Jaeger, *Quantum Information: An overview* (Springer-Verlag; New York, 2007).
[2] Gregg Jaeger, *Entanglement, Information, and the Interpretation of Quantum Mechanics* (Springer-Verlag; Heidelberg; 2009).
[3] Alisa Bokulich and Gregg Jaeger (eds.), *Philosophy of Quantum Information and Entanglement* (Cambridge University Press; Cambridge, in press).
[4] Alain Aspect, Guillaume Adenier, Gregg Jaeger, Andrei Khrennikov, *Three Experimental Tests of Bell's Inequalities by Correlation Measurements of Photon Polarization* (Springer-Verlag; Heidelberg, in progress; publication anticipated in 2010).

BOOK CHAPTERS AND ENCYCLOPEDIA ENTRIES (in chronological order):

[1] G. Jaeger, "An Outline of the Philosophy of Science in the Twentieth Century," *Zbornik Radova: Twentieth Anniversary Volume* (University of Tuzla; Tuzla Bosnia-Herzegovina, 1997), p. 223.
[2] G. Jaeger, A.V. Sergienko, "Multi-photon Interferometry," in E. Wolf (ed.) *Progress in Optics* **42** (2001), p. 277.
[3] G. Jaeger, S. Sarkar, "Coherence, Entanglement, and Reductionist Explanation in Quantum Physics," in J. Renn (ed.), *Revisiting the Foundations of Relativistic Physics* (Kluwer; Dordrecht, 2003), p. 523.
[4] G. Jaeger, "Quantum and Superquantum Correlations," in T. Nieuwenhuizen (ed.), *Beyond the Quantum* (World Scientific; Singapore, 2007), p. 146.
[5] G. Jaeger, "Double-slit Experiment," in B. Falkenburg, D. Greenberger, K. Hentschel, F. Weinert (eds.), *Compendium of Quantum Physics* (Springer-Verlag; Heidelberg, 2009).
[6] P. Busch and G. Jaeger, "Which-Way Experiment/Welcher-Weg Experiment," in B. Falkenburg, D. Greenberger, K. Hentschel, F. Weinert (eds.), *Compendium of Quantum Physics* (Springer-Verlag; Heidelberg, 2009).
[7] G. Jaeger, "Quantum Theoretical Approaches and Causality," in J. W. Haag, G. R. Peterson, and M. L. Spezio (eds.), *The Routledge Companion to Religion and Science* (Routledge; London, publication anticipated 2011)

PROFESSIONAL ACTIVITIES AND INVITED COMMUNITY SERVICE:

Conference Organization and Committees:

Co-organizer (with A. Bokulich), *Foundations of Quantum Information and Entanglement,* NSF/Boston University, Boston MA, March 24-25, 2006
Co-organizer (with G. Adenier, A. Khrennikov, T. Nieuwenhuizen, and S. Stenholm), *Foundations of Probability and Physics - 5*, Växjö, Sweden, 2008
Co-organizer (with A. Khrennikov, T. Nieuwenhuizen, H-. T. Elze, I. Bengtsson, and I. Volovich), *Quantum Theory Reconsideration of Foundations - 5*, Växjö, Sweden, 2009
Scientific Committee Member, *Frontiers of Quantum and Mesoscopic Thermodynamics*, Prague, Czech Republic, 2009.
Co-organizer (with A. Khrennikov, T. Nieuwenhuizen, and M. Schlosshauer), *Foundations of Probability and Physics - 6*, Växjö, Sweden, 2010
Program Committee Member, *UC10 - Unconventional Computation 2010*, Tokyo, Japan, 2010.

Short-term Visits:

July/August, 1996, 1997: Visiting Professor (Summer University), Department of Mathematics and Physics, Liberal Arts Faculty, University of Tuzla, Bosnia-and-Herzegovina
March, 2007: Visiting Researcher, Perimeter Institute for Theoretical Physics, Waterloo Ontario, Canada

Editorial Positions:

Editorial Board Member for the Book Series *Fundamental Theories of Physics* (Springer, since 2009)
Associate Editor, *Quantum Information Processing* (Springer, since February, 2008)
Associate Editor, *ICST Transactions on Quantum Communication* (Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering, since 2009)
Guest Editor, *Special Issue on Foundations of Quantum Information* [*Quantum Information Processing*] (Springer, 2010)
Guest Editor, *Special Issue on Quantum Theory* [*Foundations of Physics*] (Springer, 2010)

Referee Activity:

Journals: *American Journal of Physics, Europhysics B, Foundations of Physics, ICST Transactions on Quantum Communication, Journal of Modern Optics, Journal of Physics A, Optics Communications,* Physical Review Letters, Physical Review A,*Physics Letters A, Quantum Information Processing*

Books: Cambridge University Press, Springer-Verlag

Funding Agency Advising:

European Science Foundation, EU

HONORS AND AWARDS:

Ismail Sensel Award for Excellence in Research, Boston University (2007)

Biographic Listing in Who's Who in Science and Engineering (2007–present)

Kavli Fellow (2008)

DOCTOR OF PHILOSOPHY STUDENTS:

Kevin Ann, Thesis title "Sudden Death of Entanglement and Non-locality in Two- and Three-Component Systems," Department of Physics, Boston University (defense scheduled for Spring 2010)

COURSES TAUGHT:

Undergraduate: Quantum Mechanics, Statistical Thermodynamics, Calculus I, Discrete Mathematics I + II, Linear Algebra I + II, Statistics, The Scientific Revolution, Scientific Revolutions (I. Evolutionary Theory, II. Cosmological Theory), Philosophy of Science.

Graduate: Philosophy of Quantum Information.

INTERNATIONAL TALKS:

"A Foundational Problem Arising from Entanglement: System Identity,"
Quantum Theory: Reconsideration of Foundations - 5, Växjö, Sweden (June, 2009). (Invited)

"Quantum Computing,"
US-French Kavli Frontiers of Science, Roscoff, France (November 2008). (Invited)

"Sudden Death of Non-locality,"
International Conference on the Foundations of Probability and Physics - 5, Växjö, Sweden (Aug., 2008). (Invited)

"Decoherence, Disentanglement and Foundations of Quantum Mechanics,"
Quantum theory: Reconsideration of foundations 4, Växjö, Sweden (June, 2007). (Invited)

"Decoherence, Entanglement, and the Foundation of Quantum Mechanics,"
Perimeter Institute for Theoretical Physics Waterloo, Ontario (March, 2007).

"Quantum Codes, Entanglement, and Decoherence,"
37th Winter Colloquium on the Physics of Quantum Electronics, Snowbird, Utah (January, 2007). (Invited)

"Fractal States for Quantum Information Processing,"
International Conference on the Foundations of Probability and Physics - 4, Växjö, Sweden (June, 2006). (Invited)

"Beyond Quantum Mechanics via Communication Complexity,"
Beyond the Quantum Lorentz Center Workshop Leiden, The Netherlands (May, 2006). (Invited)

"Exploring Multipartite Entangled States,"
36th Winter Colloquium on the Physics of Quantum Electronics, Snowbird, Utah (January, 2006). (Invited)

"Quantum Information: An Overview,"
Department of Electrical and Computer Engineering, Boston University, Boston MA (September, 2005).

"Symmetrical Multiple-qubit States for Decoherence-free Quantum Communication,"
Institut fuer Quantenelektronik Departement Physik Eidgenoessische Technische Hochschule Zuerich, Switzerland (August, 2005).

"Entangled States in Quantum Key Distribution Networks,"
Quantum Theory: Reconsideration of foundations - 3, Växjö, Sweden (June 2005). (Invited)

"Symmetry and Concatenated Quantum Codes,"
Conference on Quantum Information and Computation III,
SPIE International Symposium on Defense and Security, Orlando, FL (March, 2005).

"Symmetry and Multipartite Entanglement,"
International Conference on the Foundations of Probability and Physics - 3, Vaxjo, Sweden (June, 2004). (Invited)

"Investigating the Quantum Information Capacity of Hyperentangled States,"
SPIE Aerosense, Orlando, FL, USA (April, 2003).

"Stochastic Local Operations for Quantum Information Processing,"
US/Australia Workshop on Solid State and Optical Approaches to Quantum Information Science,
Sydney/Brisbane Australia (January, 2003).

"Lorentz Group Invariants of Multi-Photon Polarization States and Entanglement,"
Foundations of Probability and Physics - 2, Växjö, Sweden (June, 2002). (Invited)

"Minkowski Invariants from Multi-Photon Stokes Tensors," International Quantum Electronics Conference/Lasers, Applications, and Technologies: Quantum Optics, Moscow, Russia (June 22-28, 2002).

NATIONAL AND LOCAL TALKS:

"Sudden Death of Non-local Properties of Compound Quantum Systems,"
Department of Physics, Worcester Polytech, Worcester MA (November, 2009).

"Decoherence, Entanglement and Foundations of Quantum Mechanics,"
Department of Physics, Boston University, Boston University, Boston MA (March, 2007).

"Entanglement, Symmetry and Optical Quantum Memory,"
Harvard–Smithsonian Center for Astrophysics, Cambridge MA (September, 2004).

"Lorentz-Invariants of Multi-Photon Polarization States and Quantum Entanglement,"
Optical Society of America Annual Meeting, Orlando FL (September, 2002).

JOURNAL ARTICLES (in chronological order):

[1] G. Jaeger, A. Shimony and M. Horne, "Complementarity of One-particle and Two-particle Interference," *Physical Review* A **48**, 1023 (1993).

[2] G. Jaeger, A. Shimony and L. Vaidman, "Two Interferometric Complementarities," *Physical Review* A **51**, 54 (1995).

[3] G. Jaeger and A. Shimony, "Optimal Distinction Between Two Non-orthogonal Quantum States," *Physics Letters* A **197**, 83 (1995).

[4] G. Jaeger and S. Sarkar, "On the Distribution of Bacterial Mutants..." *Genetica* **96**, 217 (1995).

[5] G. Jaeger, C. Vigier and S. Sarkar, "Bell-type Equalities for SQUIDs...," *Physics Letters* A **210**, 5 (1996).

[6] G. Jaeger, "The Ehrenfest Classification of Phase Transitions: Introduction and evolution," *Archives for History of Exact Sciences* **53**, 51 (1998).

[7] G. Jaeger and A. Shimony, "An Extremum Principle for a Neutron Diffraction Experiment," *Foundations of Physics* **28**, 435 (1999).

[8] E. Dauler, G. Jaeger, A. Migdall, R. Datla and A.V. Sergienko, "A Two-photon Technique for Measuring Polarization Mode Dispersion with Subfemtosecond Precision," *Journal of Research of NIST* **104**, 1 (1999).

[9] A.V. Sergienko, M. Atatüre, Z. Walton, B.E.A. Saleh and M.C. Teich, "Quantum Cryptography Using Femtosecond-Pulsed Parametric Down-Conversion," *Physical Review A* **60**, R2622 (1999).

[10] N. Boeuf, D. Branning, I. Chaperot, E. Dauler, S. Guerin, G. Jaeger, A. Muller, A.L. Migdall, "Calculating Charateristics of Non-collinear Phase Matching in Uniaxial and Biaxial Crystals," *Optical Engineering* **39**, 1016 (2000).

[11] D. Rice, G. Jaeger and B.C. Sanders, "Two-coherent-state Interferometry," *Physical Review* A **62**, 012101 (2000).

[12] G. Jaeger, M. Teodorescu-Frumosu, A.V. Sergienko, B.E.A. Saleh and M.C. Teich, "Multi-photon Stokes Parameter Invariant for Entangled States," *Physical Review A* **67**, 032307 (2003).

[13] M. Teodorescu-Frumosu and G. Jaeger, "Quantum Lorentz-group Invariants of N-qubit Systems," *Physical Review A* **67**, 052305 (2003).

[14] A. V. Sergienko and G. Jaeger, "Quantum Information Processing and Precise Optical Measurement with Entangled-photon Pairs," *Contemporary Physics* **44**, 341 (2003).

[15] G. Jaeger, M. Teodorescu-Frumosu, A.V. Sergienko, B.E.A. Saleh and M.C. Teich, "Entanglement, Mixedness and Spin-flip Symmetry in Multiple-qubit Systems," *Physical Review* A **68**, 022318 (2003).

[16] G. Jaeger, "Bell Gems: The Bell basis generalized," *Physics Letters* A **329**, 425 (2004).

[17] G. Jaeger, "Fractal States in Quantum Information Processing," *Physics Letters* A **358**, 373 (2006).

[18] K. Ann and G. Jaeger, "Disentanglement and Decoherence in Two-spin and Three-spin Systems under Dephasing," *Physical Review* B **75**, 115307 (2007).

[19] K. Ann and G. Jaeger, "Local-dephasing-induced Entanglement Sudden Death in Two-Component Finite-dimensional Systems," *Physical Review* A **76**, 044101 (2007).

[20] G. Jaeger and K. Ann, "Disentanglement and Decoherence in Pairs of Qutrits under Dephasing Noise," *Journal of Modern Optics* **65**, 2327 (2007).

[21] K. Ann and G. Jaeger, "Entanglement Sudden Death in Qubit–Qutrit Systems," *Physics Letters* A **372**, 579 (2008).

[22] G. Jaeger and K. Ann, "Local Basis-dependent Noise-induced Bell-nonlocality Sudden Death in Tripartite Systems," Physics Letters A **372**, 2212 (2008).

[23] G. Jaeger and A. V. Sergienko, "Constructing Four-photon States for Quantum Communication and Information Processing," *International Journal of Theoretical Physics* **47**, 2120 (2008).

[24] K. Ann and G. Jaeger,
"Generic Tripartite Bell-nonlocality Sudden Death under Local Phase Noise,"
Physics Letters A **372**, 6853 (2008).

[25] K. Ann and G. Jaeger,
"Finite-time Destruction of Entanglement and Non-locality by Environmental Influences,"
Foundations of Physics **39**, 790 (2009).

[26] G. Jaeger,
"Individuation in Quantum Mechanics,"
Foundations of Physics (accepted, 2010).

[27] G. Jaeger and A. V. Sergienko,
"Entanglement Sudden Death: A Threat to Advanced Quantum Key Distribution?"
Theoretical Computer Science (under review).

PATENTS:

[1] G. Jaeger, "Method and Apparatus for Creating at Least One Qubit in a Quantum Computing Device,"
U.S. Patent No. 6,633,053 (2003).

[2] G. Jaeger, "Method and System for the Quantum Mechanical Representation and Processing of Fuzzy Information,"
U.S. Patent No. 6,675,154 (2004).

ARTICLES IN CONFERENCE PROCEEDINGS (in chronological order):

[1] G. Jaeger and A. Shimony, "Complementarity and Path Distinguishability...,"
Proceedings of Third International Workshop on Squeezed States and Uncertainty Relations, Baltimore, MD (1994), p. 523.

[2] A.V. Sergienko, G. Jaeger and A. Migdall,
"Using Correlated Photons to Measure Polarization Mode Dispersion with Attosecond Resolution,"
in R. Blatt *et al.* (eds.) *Laser Spectroscopy: XIV International Conference, Innsbruck, Austria, June 7-11, 1999* (World Scientific; Singapore, 1999)

[3] A. V. Sergienko, G. Di Giuseppe, G. Jaeger, B. E. A. Saleh, M. C. Teich,
"Quantum Cryptography with Hyper-entangled States,"
Proceedings International Conference on Squeezed States and Uncertainty Relations, Boston, MA 2001 (2002).

[4] G. Jaeger, M. Teodorescu-Frumosu, A. V. Sergienko, B. E. A. Saleh and M. C. Teich,
"Invariants of Multiple-qubit Systems under Stochastic Local Operations," in A. Khrennikov (ed.),
Foundations of Probability and Statistics - 2 (Univ. Växjo; Växjo Sweden, 2002), p. 273 (also quant-ph/301174).

[5] A.V. Sergienko, M. Atature, G. Di Giuseppe, G. Jaeger, Saleh, B. E. A., M.C. Teich,
"Hyper-entangled States and Free-Space Quantum Cryptography,"
Proceedings of SPIE **4821**, 41 (2002).

[6] A. V. Sergienko, G. Di Giuseppe, G. Jaeger, B. E. A. Saleh, M. C. Teich,
"Quantum Metrology and Quantum Information Processing with Hyper-entangled Quantum States,"
in A. Shumovksy and V. I. Rupasov (eds.), *Quantum Communication and Information Technologies* (NATO-ASI; Bilkent, Turkey 2003), p. 13.

[7] G. Jaeger, "Entanglement and Symmetry in Multiple-Qubit States: A geometrical approach,"
Proceedings Conference Foundations of Probability and Physics - 3,
AIP Conference Proceedings **750**, 180 (2005).

[8] G. Jaeger, "Symmetry and Concatenated Quantum Codes,"
in E. Donkor *et al.* (eds.) *Quantum Information and Computation III*,
Proceedings of SPIE **5815**, 27 (2005).

[9] G. Jaeger and A. V. Sergienko, "Entangled States in Quantum Key Distribution,"
Proceedings Conference on Quantum Theory, Reconsideration of Foundations - 3,
AIP Conference Proceedings **810**, 161 (2006).

[10] G. Jaeger, "Fractal States for Quantum Information Processing,"
Proceedings Conference on Foundations of Probability and Physics - 4,
AIP Conference Proceedings, **889**, 120 (2007).

[11] G. Jaeger and K. Ann, "Decoherence, Disentanglement, and Foundations of Quantum Mechanics," Proceedings Conference on Quantum Theory, Reconsideration of Foundations - 4, *AIP Conference Proceedings* **962**, 108 (2007).

[12] G. Jaeger and K. Ann, "Non-locality Sudden Death in Tripartite Systems," Proceedings Conference on Foundations of Probability and Physics - 5, *AIP Conference Proceedings* **1101**, 78 (2009).

BOOK REVIEWS:

[1] G. Jaeger "Bohmian Mechanics and Quantum Theory: An appraisal," *Studies in History and Philosophy of Modern Physics* **35**, 105 (2000).

[2] M. Le Bellac and G. Jaeger, "A Short Introduction to Quantum Information and Quantum Computation," Physics Today **60**, 64 (May, 2007).

FUNDED GRANTS:

[1] A. Bokulich (PI) and G. Jaeger (Co-PI), "Conference: Foundations of Quantum Information and Entanglement," NSF/SES Award No. 0522832 (2006).

[2] G. Jaeger (Co-PI), B. E. A. Saleh (Co-PI), A. V. Sergienko (PI), and M. C. Teich (Co-PI), "Phase-sensitive Quantum-Optical Sensor," Department of Defense/Army. BAA06-47 (2007).

[3] G. Pierce (PI), J. Masters (Co-PI), L. O'Brien Hallstein (Co-PI), W. Tilchin (Co-PI), and G. Jaeger (Co-PI), "Developing a Culture of Assessment for Interdisciplinary Learning," Davis Educational Foundation (2009).